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Metaphor, Symbolic Play, and Logical Thought in Early Childhood

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ABSTRACT. Development of the ability to understand diverse types of metaphor was examined in terms of play context (symbolic vs. constructive-object play), Piagetian operational level (preoperational vs. concrete–operational), and medium of presentation (pictures vs. words). Forty 4-year-olds and 80 6-year-olds (40 preoperational, 40 concrete–operational) were presented with six different types of metaphorical relationships (color, shape, physiognomic, cross-modal, psychological–physical, and taxonomic matches) in both pictures and words in a match-to-sample design. Results indicated that (a) constructive-object play, rather than symbolic play, facilitated the understanding of perceptual and taxonomic metaphor, suggesting differences in early styles of metaphoric usage; (b) despite previous findings, the study failed to replicate a relationship between operativity and metaphoric understanding; and (c) younger children did significantly better in the pictorial medium, suggesting a picture-superiority effect for more perceptible metaphorical relations (perceptual and physiognomic), whereas older children showed a word-superiority effect for more conceptual metaphors (psychological–physical and taxonomic).

IT HAS BEEN MAINTAINED that metaphoric similarity is a "cross-category phenomenon in which objects and events ordinarily unrelated are brought together by virtue of some shared feature" (Kogan, 1983, p. 656; Tourangeau & Sternberg, 1982). For example, a child points to a plate full of spaghetti and labels it "worms." Here the shared feature is the cylindrical shape common to the two objects. Metaphoric similarity, or what Ortony referred to as *nonliteral similarity* (Ortony, 1979) and Gardner and his associates called *unconventional cat-*

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egorization (Mendelsohn, Robinson, Gardner, & Winner, 1984), has its roots in early perception, action, and affective experience that in development are captured in various symbol systems—typically, language (Verbrugge, 1979). Nonliteral similarity, or conventional categorization, contrasts with literal similarity, or conventional categorization, in that the latter is a same-category phenomenon in which there is no violation of category boundaries. That is not to claim, however, that similarity underlies the formation of categories. Black (1962) suggested that "metaphor creates the similarity . . . [rather than] formulat[ing] some similarity antecedently existing" (p. 37). Recent reviews have indicated that similarity is not a sufficient condition for category membership (e.g., Murphy & Medin, 1985). Given this framework, metaphor is conceptualized as a single or correlated set of cognitive mechanisms that are brought to bear on diverse symbolic instantiations (see Miall, 1979).

Metaphor

I chose to study metaphor because it has been argued to form the kernel of creative thought (Ricoeur, 1981). Whereas a traditional divergent thinking task taps the breadth of a child's real-world categories (Guilford, 1950), children perceive the similarity between disparate categories, the heart of creative thought, on chiefly metaphoric grounds (Kogan, 1983). For the purposes of the present study, I defined metaphorical thought as the ability to link disparate perceptual, affective, and conceptual domains. These include the perceptual domains of movement, color, and shape (Dent, 1984; Winner, McCarthy, & Gardner, 1980); cross-modal or "synesthetic" ability to perceive likeness in different sensory modalities (Gardner, 1974; Kogan, 1983), both originating in infancy; and rudimentary physiognomic experiences (the attribution of affective properties to visually perceived objects) gaining prominence in the early preschool years (Seitz & Beilin, 1987). Later developing metaphorical abilities are predominantly the result of conceptual and linguistic development, although they arise from earlier category abilities (Bornstein, 1984). They include the capacity to link the psychological and physical domains (e.g., Asch & Nerlove, 1960) and to compare an abstract property of two different things lacking in physical resemblance (e.g., Tourangeau & Sternberg, 1982).

Domains are demarcated by (a) biological constraints, such as the maturation of the cross-modal zones in the parietal cortex, which enables the linking of sensory modalities that are not fully mature until the beginning of the fifth year of life; and (b) constraints on concepts arising from earlier category abilities (Mervis & Rosch, 1981). For instance, Seitz and Beilin (1987) have argued that attributing affective properties to inanimate objects may function as a precursor to the later developing ability to link the psychological and physical domains.

Metaphor is thus central to creativity because it involves the ability to detect unity in variety. Although usually thought of as a linguistic device, it has been ar-

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gued to be a core element in artistic photography, film, dance, sculpture, and painting (Goodman,1976). Regarding its putative relation with literal language, Lakoff and Johnson (1980) have contended that metaphor is an important component of ordinary language used by adults to build up and use their conceptual systems in understanding the everyday world. Consequently, creative processes, in terms of metaphoric understanding and symbolic play, share much in common with "ordinary" psychological processes, whether in the ability of the infant to discriminate color hues, the increasing competence of the preschool child to categorize the natural world, or the school-age child's amassing of real-world knowledge in solving complex problems.

At each developmental level, one observes both *protometaphorical* or *protocreative* abilities operating alongside "ordinary" psychological processes. For instance, the infant can detect the synchrony between visual and auditory stimuli (Wagner, Winner, Cicchetti, & Gardner, 1981) and the preschool child can cross-classify experience in using a piece of string in play, calling it a "snake" (Winner et al., 1980). Likewise, the school-age child possesses some ability to discover the motivations underlying human behavior in attributions of physical properties to psychological states, such as in the utterance, "Tommy is as hard as a rock" (Cicone, Gardner, & Winner, 1981).

Although the perceptual domains (shape, color, movement, physiognomic, and synthesthetic abilities) have been investigated in various studies in preschool children, the primary medium has been language, with a few notable exceptions (e.g., Gardner, 1974; Seitz & Beilin, 1987). Moreover, there is not a consistent portrayal of the domains' developmental emergence in preschoolers. The conceptual domains (psychological–physical and taxonomic) have been studied hardly at all, and what results have been reported were gathered in studies of school-age children (Kogan, Connor, Gross, & Fava, 1980) using linguistic material (e.g., Cicone et al., 1981). As a result, there is not an overall portrait of how various metaphoric content emerges in the preschool years and what may be important developmental antecedents.

I undertook the present study to remedy this situation. I presented 4- and 6-year-olds with metaphorical relationships in both pictures and words. The core task consisted of a match-to-sample metaphoric comprehension task (target, nonliteral match, literal match) comprising color, shape, physiognomic, cross-modal, psychological–physical, and taxonomic matches. For example, with regard to perceptual matches, a child might compare a cherry lollipop to a frying pan (shape) or to blood (color). In such an instance, the child specified a similarity between two objects that on the surface had little in common. The similarity or "ground" for the match was based on nonliteral features of shape or color rather than on literal features, such as comparing a cherry lollipop to an orange one. Cross-modal or synesthetic metaphors involved cross-classifying sensory modalities, as in comparing a sound to a smell or visual experience to touch. Physiognomic matches involved projecting emotional qualities onto objects that could be visually perceived—for example, saying that a pretzel looks like a human face that is smiling. Psychological–physical matches compared a physical aspect of an object to a psychological characteristic or mental state of a person, as in the example, "He was as hard as a rock." Taxonomic matches equated an abstract property of two different things between which there was no physical resemblance—for example, comparing a violin to a singing canary. In all cases, the target (e.g., *unfriendly man*) had one picture/word item that was related by nonliteral similarity (e.g., *rock,* as in comparing an unfriendly man to a rock) and one that was related by literal contiguity (e.g., *shoes,* as a part of clothing). Thus, children matched items based on either metaphoric (paradigmatic) relations or metonymic (syntagmatic) relations (Jakobson, 1981; Nelson, 1977; Winner et al., 1980).

Symbolic Play

Theoretical claims for the close correspondence between play and metaphoric behaviors have been made in the literature, particularly from the naturalistic observation of symbolic play in young children (Winner, 1979; Winner, McCarthy, Kleinman, & Gardner, 1979). However, there is little empirical evidence to substantiate such claims. The prevailing view is that play "seems to develop a more generalized attitude and/or scheme which predisposes the individual to creating and using novelty" (Vandenberg, 1980). Symbolic play should display some "family resemblance" to metaphoric comprehension and production because both could be argued to possess an underlying similarity common to systems of *nonostensive* reference, in which a signifier stands in place of a signified. According to Ricoeur (1978), in the act of understanding a metaphorical relation between two things, a dual system of reference is involved between literal similarity (the "world" of reality) and nonliteral similarity (the "world" of the metaphor). Metaphor, like pretend play, involves suspension of reference to the everyday world—hence, the referent (e.g., an imaginary horse) is termed nonostensive, making possible a new creative reference, a "remaking of reality."

A significant relation between symbolic play and various cognitive abilities has been investigated in language (e.g., Hudson & Nelson, 1984), symbolic transformation of objects (e.g., Ungerer, Zelazo, Kearsley, & O'Leary, 1981), and conservation tasks (e.g., Golomb & Cornelius, 1977). Other researchers have reported the effects of different kinds of play on problem-solving skill (e.g., Sylva, Bruner, & Genova, 1976) and divergent-thinking indices (e.g., Dansky & Silverman, 1973).

Pepler and Ross (1981) found specific facilitating effects for convergent (goal-oriented) play on convergent problem-solving abilities, whereas divergent (nongoal-oriented) play had a generalizing effect across both convergent and divergent tasks. To investigate the relationship of metaphor and symbolic play, I gave a series of symbolic play tasks to half of the participants in each age group, with the other half receiving tasks of constructive-object play. I hypothesized that

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Medium of Presentation

Metaphor is commonly thought of as an embellishment of language—the Aristotelian perspective. Recent research has shown, however, that metaphor is comprehended across different media of presentation (e.g., Kogan et al., 1980). Nonverbal tasks that highlight perceptual or functional similarity have enabled young children to make metaphorical comparisons at early ages. In the present study, both picture and word triads were presented to children experimentally crossed with the different metaphorical types. I hypothesized that visual metaphor tasks facilitate understanding in the younger age group, with the effect as a function primarily of age rather than medium, because of a *picture-superiority effect.* Reznick (1977) found such an effect: pictorial media, more than linguistic media, facilitated children's performances across a range of tasks. Nevertheless, Kogan and Chadrow (1986) did not find a pictorial advantage in a study of metaphoric comprehension in second and fifth graders, although the children were significantly older, ranging in age from 7 years to 10 years, 7 months. Reznick (1977) suggested, however, that there is with increasing age an increasing integration of the visual and verbal modalities, which eventually washes out the pictorial superiority effect.

Metaphor and Concrete Operations

A standing but unresolved issue in the research on metaphor is whether concrete operations are a logical precondition for metaphoric comprehension. Some have maintained that they are (Billow, 1975; Cometa & Eson, 1978; Ricco & Overton, 1985), but their research can be faulted for using inappropriate Piagetian tasks (Billow, 1975; Ricco & Overton, 1985) or requiring extensive linguistic and metalinguistic skills (Cometa & Eson, 1978). Moreover, a substantial body of research suggests that classification abilities, the hallmark of concrete–operational thought, emerge in infancy (Mervis & Rosch, 1981). Nonetheless, the claim is surprising because Piaget (1962) himself maintained that metaphors were "preconcepts" and thus a symptom of preoperational thought and a common characteristic of young children's thinking.

To test the claim that operativity is necessary to comprehend metaphor, I divided the group of 6-year-olds into two equal groups of preoperational and concrete–operational children. For the assessment of the Piagetian stage, I administered conservation of liquid and solid quantity tasks to the 6-year-olds. Other studies have included a diverse assortment of Piagetian tasks and procedures to index operativity. For instance, Billow (1975) used a class inclusion-like task to assess concrete operations in boys 5 to 14 years of age. The task was derived from the metaphor stimuli and required making indeterminate hierarchical distinctions from abstract knowledge of real-world relations. The task was in fact a poor measure of class inclusion, because it confounded the hierarchical relation between classes—that is, "(1) All A are some B; (2) A < B" (Inhelder & Piaget, 1969, p. 8). Moreover, it has been argued that the ability to distinguish literal from nonliteral similarity, rather than knowledge of class inclusion and hierarchical ordering, lies at the heart of metaphor (Vosniadou & Ortony, 1983).

On the other hand, Ricco and Overton (1985) used seriation and conservation of number and length tasks. They asserted that preoperational participants were generally unable to differentiate categorical from noncategorical (perceptual) similarity. However, the tasks they used to assess operativity were poor indices of the abilities they were trying to measure—classification skills. In the case of Cometa and Eson (1978), extensive lexical knowledge about individual target words was needed to understand the metaphoric sentences. The seven sentences themselves involved comparing psychological states to physical aspects of the world or abstract resemblances between perceptually dissimilar things—both quite advanced metaphoric operations. Their requirement of adult norms of paraphrase and explanation required the use of linguistic and metalinguistic skills that are not available to younger children, who lack experience in formal schooling, with its emphasis on precise and literal language use (Scribner & Cole, 1981) and the accumulation with age of the real-world knowledge essential to understanding the underlying intent of the metaphor. To be sure, even adults have difficulty explaining the basis of some common metaphors and proverbs (Richardson & Church, 1959).

Given the claim that operational thought is a prerequisite for the understanding of metaphor, I used standardized procedures in the administration of the conservation of liquid and solid quantity tasks. I predicted that skills in conservation would have no effect on metaphoric understanding when the effects of age and schooling were controlled. As for the metaphor measures, the match-to-sample procedures required simply pointing to indicate a nonliteral or literal match and an explanation to justify the child's choice. I counted the former as indicative of partial knowledge of nonliteral similarity, rather than eliminating the significance of the child's preference altogether. Evidence suggests that in young children, production, comprehension, and preference proceed at different rates (Gardner, Kircher, Winner, & Perkins, 1975).

Method

Participants

The participants were forty 4-year-old (range = 4.0 to 4.11 years, M = 4.5 years) and eighty 6-year-old (range = 6.0 to 6.11 years, M = 6.6 years) middle-class, multiethnic children whose first language was English. All of the 6-year-

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Materials and Procedure

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olds were enrolled in the first grade. The children were recruited from early-childhood centers and private and public schools in the New York City metropolitan area. All of the children were given parental consent forms, and only those children who received parental consent were included as participants.

Materials and Procedure

Metaphor comprehension tasks. Each picture or word was drawn or printed on 12.5 cm × 17.5 cm heavy-weight paper art supply cards. Words were generated on an Apple Macintosh PC; they were centered, in boldface, and approximately 2.5 cm in height. Pictures were hand-drawn in pen, ink, and colored pencils by a graphic artist. From an original sample of 42 pilot triads, I selected 16 from the six categories: 2 from color, 2 from shape, and 3 each from physiognomic, cross-modal, psychological–physical and taxonomic (see Appendix). In constructing psychological–physical metaphors, I derived chronological word norms for emotion words from Ridgeway, Waters, and Kuczaj (1985). I used only basic-level terms from the top 75 items of the list.

Two naive adult judges were instructed in the use of the six-category system and asked to classify the 16 picture triads for the nonliteral matches. They were informed that the categories were not mutually exclusive (they could be subsumed under more than one category). There was 93.8% interrater agreement between them on the assignment of a primary classification of an item to a category. Similarly, two additional naive adult judges rated the corresponding word triads. There was 87.5% interrater agreement between them on the assignment of an item to a primary classification.

The child and the experimenter were seated across from each other at a small desk or table (whatever was available at the school location). The experimenter laid out the target item in front of the child on the table and then, in randomized order, the literal or nonliteral items above and to the left and right of the child. The experimenter pointed to the bottom item (target) and asked the child to pick one of the top two items that was "like" the bottom one: "Is this [points to target] like this [points to item on left] or like this [points to other item]?" The child was then asked to explain the basis for her or his answer; the experimenter used the accompanying verbal probes "How are they like each other?" "Could you tell me other ways that they are like each other?" If children could not read a word by themselves, the experimenter read the word. If a child made a literal match on the first trial (of a triad), the experimenter pointed to the nonliteral item and asked the child whether it "was like" the target item and to explain the answer. Piloting determined that "like" facilitated metaphoric (nonliteral) responding, whereas "go together" promoted literal responding; therefore, the former was used. Stimuli were laid out in two tiers, to inhibit thematic responding, that is, making up a story about the items. Responses were both written down and recorded on an Aiwa TPS-30 cassette recorder.

Conservation tasks. The material used in the conservation of liquid quantity task consisted of three glasses, two 7.3 cm × 7.6 cm and one taller and thinner, 6.3 cm × 12.9 cm, and yellow-colored water. The conservation of solid quantity task involved two balls of yellow playdough approximately 5 cm in diameter. I adopted the procedure directly from Golomb and Cornelius (1977); it was rated on a 3-point scale. A score of zero reflected an incorrect conservation judgment, a score of 1 designated a correct conservation judgment with an inadequate explanation, and a score of 2 indicated a correct conservation judgement with an adequate explanation. Only explanations invoking identity, inversion, and compensation (Inhelder & Piaget, 1969) were classified as conserving responses. Thirty percent of the conservation task protocols were rated by two independent judges. There was 98% agreement on the assignment of conservation scores.

Separate groups of 40 preoperational and 40 concrete–operational participants were generated from a larger sample of 6-year-old children. All 40 concrete–operational 6-year-olds passed both of the conservation tasks. The preoperational 6-year-olds consisted of 39 of the 40 (97.5%) who failed to pass the conservation of liquid quantity task and 28 of the 40 (70%) who failed to pass the conservation of solid quantity task. Overall, 13 of 40 (32.5%) passed only one conservation task, and 4 of those children (10%) were considered transitional (invoking an inadequate justification) according to standard Piagetian criteria.

Symbolic play tasks. For the child-initiated part (Game 1), symbolic play stimuli consisted of an animal hand puppet ("Minnie Mouse"), five colored blocks, and a stuffed animal ("Garfield"). For the adult-initiated part, stimuli consisted of red playdough (Game 2); a ball of yarn, a fluffy beanie cap, and two kitchen sponges (Game 3); an animal hand puppet (a green frog named Wally), pebbles, and a shoebox (Games 4 and 5). Each game engaged the child in a pretend situation. Then the experimenter "played dumb," to inquire of the child how the play object could be two different things, itself and a make-believe one. The child was prompted to explain the symbolic function and its reversible nature. The tasks were adapted from Golomb and Cornelius (1977).

In the child-initiated part, the games involved further role adoption and object transformation. The experimenter asked the child to do something (e.g., go on a picnic) and then, as the game moved along, stepped out of his pretend role and asked a series of questions requiring the child to elaborate on the pretend action and object—for example, "How can playdough be a hamburger? Why?" The child was encouraged to explain how an object can be both itself and a make-believe thing and how that was brought about. The symbolic play tasks lasted approximately 20 min per child.

Constructive-object play task. The stimuli consisted of a white plastic form board, 16 cm × 21.5 cm, and colored pegs approximately 1.5 cm in diameter. The children were presented with the materials and told that they could make whatever they wished. Each child was allowed to play with the form board for 20 min.

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consisted of a white plastic form
ɔroximately 1.5 cm in diameter. The
nd told that they could make what-
ɔlay with the form board for 20 min.

The symbolic play and constructive-object play tasks were administered twice, on 2 consecutive days, with the second administration immediately before administration of the metaphor tasks.

Semantic features task. To assess whether the 4- and 6-year-olds knew certain key features necessary for comprehending the visual metaphors used in the metaphor comprehension tasks, I established a separate pilot group of five 4-year-olds (range = 4.5 to 4.10 years, M = 4.7 years) and five 6-year-olds (range = 6.0 to 6.11 years, M = 6.7 years). For each picture in each triad, they were asked a series of questions designed to tap relevant information necessary to comprehend the metaphorical relations, such as information about the ground, and key features in the pictures, such as pictorial "runes" (Kennedy, 1982). Children appear to be well acquainted with this kind of nonmimetic information (e.g., waft lines to connote odor) by 4 years of age (Friedman & Stevenson, 1980; Newton, 1985). I adapted the task from Nippold, Leonard, and Kail (1984). Ninety-five percent of the individual pictures in the metaphor triads were correctly identified by the 4-year-olds, and 98% were correctly identified by the 6-year-olds.

Word recognition task. For all 48 words (3 × 16 triads), a separate pilot group of participants, five 4-year-olds (range = 4.0 to 4.10 years, M = 4.4 years) and five 6-year-olds (range = 6.3 to 6.10 years, M = 6.6 years) were asked to identify and define the word on each card. The task was adapted from Nippold et al. (1984). Ninety-eight percent of the individual words in the metaphor triads were correctly identified and defined by the 4-year-olds and 99% were identified and defined by the 6-year olds.

Results

Scoring of Nonliteral Matches

I used a 3-point scale, directly adopted from Kogan et al. (1980), to quantify a child's understanding of nonliteral similarity within each triad. According to the scale, the scores from 0 to 2 represented the following:

0: Child matched on a literal basis or gave no response at all.

1: Child demonstrated partial knowledge of the nonliteral similarity but failed to offer an adequate explanation. (E.g., for Triad #8, consisting of sweet perfume, bright sunshine, and a bottle top, a child responded, "That's spraying and the sun is shining." This response was a purely perceptual one, failing to demonstrate understanding of an underlying cross-modal equivalence.)

2: Child demonstrated complete knowledge of the underlying nonliteral similarity as revealed through an appropriate explanation. (E.g., for Triad #14, a child responded, "The bird sings sometimes and you can use it (violin) to make music." This response correctly identified the conceptual equivalence underlying the match.)

The child's score multiplied by the number of triads within each metaphorical type yielded the dependent variable. Total scores were derived by summing across participants and type of metaphor. To assess interrater reliability of scoring, I used a sample of 30% of the protocols and two independent adult judges. There was 98.7% agreement on the assignment of a score within a triad.

Parametric Analyses

To assess the effects of stage, age, medium, and task on metaphoric understanding, I submitted the variables to a 2 (stage) × 2 (age) × 2 (medium) × 2 (task) multivariate analysis of variance (MANOVA), with type (shape, color, physiognomic, cross-modal, psychological-physical, or taxonomic) as the within-subject variable.[1] I used separate univariate analyses of variance (ANOVAs) to assess main effects and two-way ANOVAs to assess significant higher order interactions.

Piagetian stage. The effect of stage for the 6-year-olds was nonsignificant, Pillai's $F(6, 103) = 1.01$, $p > .4$.[2] Separate one-way ANOVAs were computed for each dependent variable, but all were nonsignificant ($p > .05$): color, $F(1, 78) = .00$, $p = 1.00$; shape, $F(1, 78) = .11$, $p = .74$; physiognomic, $F(1, 78) = .59$, $p = .71$; cross-modal, $F(1, 78) = .23$, $p = .84$; psychological–physical, $F(1, 78) = .43$, $p = .84$; and taxonomic matches, $F(1, 78) = .13$, $p = .87$.

Age differences. MANOVA indicated that age was significant, Pillai's $F(6, 103) = 14.17$, $p < .001$. I computed univariate ANOVAs for each dependent variable to further assess the age effect. For each metaphorical type, I found a significant difference, with the 6-year-olds favored in all cases (see Table 1).

I then broke down the percentages of nonliteral matches by age and type and whether participants responded in terms of partial knowledge, a score of 1, or with an adequate explanation, a score of 2 (see Table 2). Tabulated data indicated that in comparison with the 4-year-olds, 6-year-olds displayed (a) a much higher percentage of metaphorical responses across all seven metaphorical types and (b) a much higher percentage of adequate explanations.

Medium effects. The effect of medium was significant, Pillai's $F(6, 103) = 12.14$, $p < .001$. I computed univariate ANOVAs for each dependent variable. Pictures

[1]SPSS^x MANOVA takes account of unequal cell sizes by using the regression approach to partition nonorthogonal sums of squares.

[2]Pillai's Trace is the most robust criterion of significant differences among groups available on SPSS^x MANOVA and takes account of unequal cell sizes by using the regression approach to partition nonorthogonal sums of squares.

facilitated the comprehensior
taxonomic matches, $F(1, 11$
significant, $F(1, 118) = 0.31$,
The Age × Medium inte
action, Pillai's $F(6, 103) = 4.$
sessed for each dependent va
5.15, $p < .05$; as were shape
nomic matches, $F(1, 116)$ =
reached significance, $F(1, 11$
six metaphorical types, the 6-
and picture tasks. The mean
task. However, the Age × Me

Mean Scores

Type	Err
Perceptual/color	.10
Perceptual/shape	.13
Physiognomic	.15
Cross-modal	.13
Psychological–physical	.12
Taxonomic match	.13

***$p < .001$.

Percentage of Nonlitera

Metaphor type	4- Score 1
Perceptual/color	14
Perceptual/shape	12
Physiognomic	26
Cross-modal	21
Psychological–physical	23
Taxonomic match	17

Note. Score of 1 = inadequate explanatior facilitated the comprehension of color matches, $F(1, 118) = 24.45$, $p < .001$, and taxonomic matches, $F(1, 118) = 5.76$, $p < .02$. Physiognomic matches were not significant, $F(1, 118) = 0.31$, $p > .05$.

The Age × Medium interaction was the only significant higher order interaction, Pillai's $F(6, 103) = 4.73$, $p < .001$. Separate two-way ANOVAs were assessed for each dependent variable. Color matches were significant, $F(1, 116) = 5.15$, $p < .05$; as were shape matches, $F(1, 116) = 7.56$, $p < .01$; and physiognomic matches, $F(1, 116) = 19.21$, $p < .001$. Cross-modal matches nearly reached significance, $F(1, 116) = 3.71$, $p < .06$. The results indicated that for all six metaphorical types, the 6-year-olds had larger mean differences on both word and picture tasks. The mean differences were greater, moreover, for the word task. However, the Age × Medium interaction was driven by the greater number

TABLE 1
Mean Scores and *F* Ratios for the Effect of Age

Type	Error	4-year-olds ($n = 40$)	6-year-olds ($n = 80$)	*F*
Perceptual/color	.109	1.93	2.93	22.11***
Perceptual/shape	.133	1.70	3.54	65.47***
Physiognomic	.150	2.23	3.94	37.87***
Cross-modal	.136	1.33	2.53	20.16***
Psychological–physical	.124	1.45	2.61	23.25***
Taxonomic match	.135	1.40	2.80	29.88***

***$p < .001$.

TABLE 2
Percentage of Nonliteral Matches, by Age and Scoring ($N = 120$)

Metaphor type	4-year-olds			6-year-olds		
	Score 1	Score 2	Total	Score 1	Score 2	Total
Perceptual/color	14	35	49	17	64	81
Perceptual/shape	12	34	46	3	85	88
Physiognomic	26	13	39	27	43	70
Cross-modal	21	16	37	20	46	66
Psychological–physical	23	1	24	45	4	49
Taxonomic match	17	6	23	23.5	23.5	47

Note. Score of 1 = inadequate explanation. Score of 2 = adequate explanation.

of 6-year-old participants. Therefore, I submitted the data to further univariate ANOVAs, to assess the effects of age and medium separately (see Table 3).

Within age, the 4-year-olds performed significantly better on the perceptual (color/shape) and physiognomic picture tasks. They achieved equivalent performance in both media for cross-modal, psychological–physical, and taxonomic matches. The 6-year-olds did significantly better on color matches in pictures and on physiognomic, cross-modal, psychological–physical, and taxonomic matches in words. Across age, the 6-year-olds did significantly better on perceptual (color/shape) and taxonomic matches in the pictorial medium and on all six metaphoric matches in the linguistic medium.

Symbolic and constructive-object play tasks. The effect of task was significant, Pillai's $F(6, 103) = 3.72$, $p < .002$. I computed univariate ANOVAs for each dependent variable (see Table 4). The results indicated that the symbolic play tasks did not facilitate the understanding of metaphor across any of the six types. The constructive-object play task, however, facilitated the understanding of perceptual and taxonomic matches.

Discussion

Media Differences

The 4-year-olds exhibited a marked picture superiority effect. They performed significantly better on the perceptual and physiognomic matches in pictures and showed a far better understanding of metaphorical relations in the perceptual domains overall. Color matches were also easier for the 6-year-olds when displayed pictorially, but for more conceptual matches (psychological–physical and taxonomic), they performed significantly better in the linguistic medium. Across age, the 6-year-olds did appreciably better on perceptual and taxonomic matches displayed pictorially, suggesting a greater picture superiority effect for older children; that effect, however, was attenuated when compared with their superiority on all six metaphorical types in the linguistic medium. Moreover, they showed an advantage in the understanding of metaphorical relations in the two conceptual domains. Nonetheless, the effect of medium on metaphoric understanding indicated that for both the 4- and 6-year-olds, metaphoric relations of color and shape were best conveyed through pictorial depictions. Likewise, cross-modal, psychological–physical, and taxonomic metaphorical relationships were best communicated through the linguistic medium.

One curious finding for the group of 6-year-olds was their significantly better performance on physiognomic and cross-modal matches in the linguistic medium. It must be admitted that cross-modal matching is probably not well highlighted in the visual modality, particularly given the nature of the sensory cross-classifications used in the present study (visual–olfactory, auditory–haptic, and olfactory–auditory; Triads 8, 9, and 10, respectively). In fact, the visual ref-

TABLE 3
Mean Scores and *F* Ratios for the Effects of Age and Medium

	Metaphor type					
Age/medium	Perceptual/color	Perceptual/shape	Physiognomic	Cross-modal	Psychological–physical	Taxonomic match

TABLE 3
Mean Scores and *F* Ratios for the Effects of Age and Medium

Age/medium	Metaphor type					
	Perceptual/color	Perceptual/shape	Physiognomic	Cross-modal	Psychological–physical	Taxonomic match
4-year-olds (n = 40)						
Pictures	2.70	2.45	.90	1.25	1.55	1.40
Words	1.15	0.95	1.55	1.40	1.35	1.40
*F*1	21.36***	13.38***	8.17**	0.19	0.23	0.00
6-year-olds (n = 80)						
Pictures	3.27	3.70	3.47	1.50	2.22	2.32
Words	2.57	3.38	4.40	3.55	3.00	3.27
*F*2	11.63***	2.23	10.80**	68.36***	8.93**	10.61**
4- and 6-year-olds						
*F*3	4.72*	16.04***	2.29	1.01	3.27	7.92**
*F*4	29.91***	72.97***	65.06***	38.56***	33.66***	25.95***

Note. *F*1 = pictures–words (4-year-olds), *F*2 = pictures–words (6-year-olds), *F*3 = 4- and 6-year-olds (pictures), and *F*4 = 4- and 6-year-olds (words).
*p < .05. **p < .01. ***p < .001.

TABLE 4
Mean Scores and F Ratios for the Effect of Task

Type	Error	Symbolic play (n = 60)	Constructive play (n = 60)	F
Perceptual/color	.109	2.28	2.90	8.54***
Perceptual/shape	.133	2.62	3.23	5.59**
Physiognomic	.150	3.30	3.43	0.20
Cross-modal	.136	1.92	2.33	2.38
Psychological–physical	.124	2.10	2.35	1.02
Taxonomic match	.135	1.93	2.73	9.46***

*$p < .05$. **$p < .02$. ***$p < .005$.

erents may have thrown off the older children. Gardner (1974) circumvented this problem by presenting sensory cross-classifications in the modalities of interest; for example, color (visual), pitches (auditory), and objects felt while blindfolded (tactile). The 6-year-olds' superior performance on physiognomic matches in the linguistic medium suggests that during the latter preschool and early school years, because of the influence of schooling and the cultural emphasis on written language, there is an increasing preoccupation with the linguistic medium (Scribner & Cole, 1981). It has also been suggested that during the preschool and early school years, increasing integration of information from the visual and verbal modalities accounts for the superior performance of older children (Reznick, 1977).

Even though the development of linguistic ability is undoubtably a central achievement of childhood, Gombrich (1982) has emphasized the primacy of the visual image in experience. For example, in Gombrich's account, the use of the color blue to denote bodies of water on a map is an instance of a "natural metaphor." Perceptual and physiognomic metaphors presented in pictures are easily understood by young children because they draw on natural relationships in the world that are largely a product of biological constraints. As children begin to evolve systems of verbal elaboration and to acquire cultural knowledge, including domain-specific knowledge of language and other conventional symbol systems, they become important media of expression and comprehension. As previous studies have clearly documented, the symbolic medium embodies unique as well as common properties, whether with regard to nonverbal symbol systems (Beilin, 1983; Kose, 1985; Seidman & Beilin, 1984; Seitz & Beilin, 1987) or language proper (Olson, 1977). Furthermore, these unique and common properties appear to be differentially understood over the course of development (Beilin & Futterweit, 1988).

Operativity

Operativity did not si
metaphor under the task con
previous findings. Both the a
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its effect went undetected. C
per se but intellectual cor
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as a variable (Kogan et al.,
Humphreys, Rich, & Davey,
correlated with standard IQ t

Symbolic Play

Notably, the symbolic p
performance on the metapho
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Cognitive style. It is also con
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Effect of Task

Constructive play ($n = 60$)	F
2.90	8.54***
3.23	5.59**
3.43	0.20
2.33	2.38
2.35	1.02
2.73	9.46***

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Operativity

Operativity did not significantly contribute to the comprehension of metaphor under the task conditions examined; thus, the study failed to replicate previous findings. Both the administration of standard procedures in the conservation tasks and the relatively large sample sizes appear to rule out any claim that its effect went undetected. Of course, it may simply be that it is not operativity per se but intellectual competence, broadly construed, that contributes to metaphoric understanding. There is reason to believe that intellectual competence is an important factor, judging from metaphor studies that have included IQ as a variable (Kogan et al., 1980; Seitz & Beilin, 1987). Recent studies (e.g., Humphreys, Rich, & Davey, 1985) have shown that Piagetian tasks are highly correlated with standard IQ tests of intellectual functioning.

Symbolic Play

Notably, the symbolic play tasks did not significantly facilitate increased performance on the metaphor tasks. There are at least three possible reasons. First, it may be that two 20-min sessions in symbolic play were insufficient to stimulate metaphoric understanding. Guthrie and Hudson (1979), in a partial replication of the study of Golomb and Cornelius (1977), found that the latter's symbolic play training task was inadequate in stimulating conversation. A recent review (Smith & Whitney, 1987) suggested that previous studies that linked play with associative fluency reflected experimenters' unconscious effects, attesting to a lack of either ecological validity or a significant relation between play and creative abilities. The latter position seems unwarranted, however, for a significant relation between symbolic play and various cognitive domains has been found in numerous studies (e.g., Billow, 1981; Hudson & Nelson, 1984; Sylva, Bruner & Genova, 1976; Ungerer et al., 1981).

A second possibility is that whereas the symbolic play tasks encouraged spontaneous production, the metaphor tasks were solely tasks of comprehension. Moreover, the materials used in the two tasks differed substantially. There is evidence that in young children, production, comprehension, and preference are not significantly linked (Kogan, 1988) or proceed at different rates (Gardner et al., 1975), insofar as production precedes comprehension. Nonetheless, Marschark and Nall (1985) and Vosniadou (1987) argued that the pretend namings of symbolic play and genuine metaphoric utterances arise from separate developmental origins and represent different phenomena. Further research is needed to substantiate this claim.

Cognitive style. It is also conceivable that a cognitive-style variable contributed to the differential effects of symbolic and constructive play. Shotwell, Wolf, and Gardner's (1980) research suggested that constructive-object play produced a relatively high incidence of metaphoric behaviors, principally perceptual and enactive metaphors, for a group of very young children they designated as "patterners." Symbolic play tended to produce a relatively low incidence of metaphoric behaviors for a group of children they designated as "dramatists." These findings suggest the early evolution of children's preferences for modes of engagement with different kinds of materials. Similarly, Kogan (1988) did not find evidence of a generalized metaphoric style in first and third graders, approximately 6 and 8 years of age, when they were given a barrage of metaphoric triad tasks, sentence-completion tasks, synesthetic–physiognomic matching, and divergent-thinking indices.

The present results, then, strengthen previous claims that the manner in which children understand metaphorical relations is not limited to the linguistic medium but is embodied in other representational media as well. Therefore, if the process of metaphor making is considered an agency of thought or cognition, then different symbol systems possess differential abilities to highlight similarity. To be sure, features of color and shape are more easily highlighted in the pictorial medium and thus are more easily understandable to younger children. However, conceptual relationships, including psychological–physical and taxonomic similarity, are better highlighted in the linguistic medium. Moreover, the ability to cross conventional boundaries of experience is based on early category abilities, not attainment of concrete operations, which develops later.

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1. ice cream, clouds, scoop (
2. long haired girl, hanging p
3. stick of butter, school bus,
4. building, giraffe, window (
5. sad girl, weeping willow tr
6. tired runner, dry plant, sne
7. angry man, storm, coat (PI
8. sweet perfume, bright suns
9. soft sound, pillow, ear (CM
10. smelly trash, noisy tires, pa
11. unfriendly man, rock, shoe
12. happy man, sun, car (PP)
13. kind mother, heater, purse (
14. violin, singing bird, music
15. baby, rosebud, diapers (TX
16. fish on hook, plane on fire,

Note. PC = perceptual/color, PS = perc
psychological-physical, and TX = taxo
match, literal match.

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APPENDIX
List of Metaphor Task Items

1. ice cream, clouds, scoop (PC)
2. long haired girl, hanging plant, hat (PS)
3. stick of butter, school bus, bread (PC)
4. building, giraffe, window (PS)
5. sad girl, weeping willow tree, park bench (PH)
6. tired runner, dry plant, sneakers (PH)
7. angry man, storm, coat (PH)
8. sweet perfume, bright sunshine, bottle top (CM)
9. soft sound, pillow, ear (CM)
10. smelly trash, noisy tires, paper (CM)
11. unfriendly man, rock, shoes (PP)
12. happy man, sun, car (PP)
13. kind mother, heater, purse (PP)
14. violin, singing bird, music stand (TX)
15. baby, rosebud, diapers (TX)
16. fish on hook, plane on fire, ocean (TX)

Note. PC = perceptual/color, PS = perceptual/shape, PH = physiognomic, CM = cross-modal, PP = psychological-physical, and TX = taxonomic. The order of items in each triad is target, nonliteral match, literal match.

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